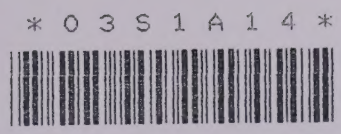
INSTRUCTION
MANUAL




# AILTECH

INSTRUCTION MANUAL
FOR
IMPULSE GENERATOR
MODEL NO. 91263-1

MANUAL NO. 1-500783-204 (REV. A)

EATON Advanced Electronics

Eaton Corporation
**Electronic Instrumentation Divisic**
Los Angeles, California 90066

# INSTRUCTION MANUAL
# FOR
# IMPULSE GENERATOR
# MODEL NO. 91263-1

MANUAL NO. 1-500783-204 (REV. A)

Reprinted 2/79 Lib.

Eaton Corporation
Electronic Instrumentation Division
Los Angeles Plant
5340 Alla Road
Los Angeles, California 90066

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5340 Alla Road, Los Angeles, California 90066

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## REPAIR AND MAINTENANCE

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Chargeable repairs: If requested, an estimate of charges will be made prior to repairs. Please provide us with the following information in order to expedite the processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(1)
4. Approximate date instrument was placed in operation.
5. Approximate number of hours in use.
6. Maintenance action previously requested or performed.
7. Other comments.

(1) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken and any other relevant data.

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Section I

# GENERAL DESCRIPTION

## 1-1. SCOPE OF THIS MANUAL

This instruction book contains instructions for the installation, operation and maintenance of the Singer Model 91263-1 Impulse Generator. Section 6 of this manual contains a list of component parts.

## 1-2. GENERAL INFORMATION

The Model 91263-1 Impulse Generator equipment provides pulse signals of very short duration and of constant amplitude. The short pulse duration provides a broadband radio frequency output that is essentially constant per unit bandwidth from 60 kilohertz to 1000 megahertz.

The Impulse Generator can be used as a secondary standard of broadband radio interference. It can be used to calibrate or determine the performance of RI-FI equipment, radio communication receivers and amplifiers in its frequency range.

## 1-3. ELECTRICAL CHARACTERISTICS

a. FREQUENCY RANGE:

60 kilohertz to 1000 megahertz, output constant within ±0.5 dB. Useful output to 10,000 megahertz.

b. PULSE DURATION:

0.0005 microseconds ($5 \times 10^{-10}$ seconds).

c. REPETITION RATE:

50 to 60 pulses-per-second, determined by power line frequency.

d. OUTPUT IMPEDANCE:

Matches 50-ohm impedance. The load must include a dc resistance of 50-ohms for proper operation.

e. OUTPUT LEVEL:*

101 dB above one microvolt-per-megahertz bandwidth, adjustable from 10 to 101 dB in 0.25 steps.

f. PULSE POLARITY:

Front Panel switch provides choice of positive or negative pulses.

g. POWER REQUIREMENTS:

105 to 125 volts or 210 to 250 volts, 50-60 hertz, 30 watts.

1-4. MECHANICAL CHARACTERISTICS:

a. DIMENSIONS:

10 inches wide, 9-1/4 inches deep, 7-3/8 inches high.

b. WEIGHT:

11-1/2 pounds.

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*The output has been calibrated in terms of rms spectral intensity. Or, impulse output is in terms of rms of a sine wave (0.707 of true peak of a sine wave) which would have the same peak amplitude as the impulse signal.

Section II

# THEORY OF OPERATION

## 2-1. GENERAL THEORY OF OPERATION

The Model 91263-1 Impulse Generator produces electrical pulses which are so short in duration as to have a frequency spectrum that is essentially flat from 60 kilohertz to 1000 megahertz. The scheme used in this equipment for the production of short pulses consists of charging and discharging a transmission line whose resonant frequency is about 1400 megahertz. The pulse amplitude and the RF power output can be varied simply by changing the d. c. charging potential.

## 2-2. CIRCUIT ANALYSIS

### a. TRANSMISSION LINE:

The heart of the generator consists of a short section of open-circuited coaxial line. The outer conductor is held at ground potential while one end of the inner conductor is connected to a calibrated voltage source through a high resistance. A mercury switch is connected in series with the other end of the inner line and the 50 ohm output circuit. Periodically the mercury switch closes, discharging the line across the 50 ohm load.

The mercury switch contacts are operated by a pulsating magnetic field generated by a coil that surrounds the line. The coil is periodically energized at power line frequency from a 6.3 volt power transformer secondary winding and a half-wave selenium rectifier.

By making the charging resistance several megohms the inner line remains effectively open-circuited at that end during the very short period required for discharging the line through the mercury contacts. Yet line capacity is so small that the RC time constant for recharging is very short compared to the charging time of approximately 8 milliseconds when the mercury switch contacts are open. The line parameters were so chosen that at the instant of discharge its self-resonant frequency as a quarter wave open-circuited transmission line is in the vicinity of 1400 megahertz. This ensures that spectral output per unit bandwidth will be substantially constant up to 1000 megahertz.

b. POWER SUPPLY:

The self-contained power supply is designed to operate from a single-phase source, 105 to 125 volts, or 210 to 250 volts, 50 to 60 hertz.

The input power for the line charging voltage is obtained from the secondary winding of transformer T101 and is rectified by silicon diode bridge, CR101. The full-wave rectified output is filtered by shunt capacitors C101 and C102 and series dropping resistor R130. Voltage regulation and additional filtering is achieved by dropping resistor, R101 and four gaseous regulator tubes, V101 through V104, in series to provide a nominal output voltage of 600 volts. This circuit, from the transformer winding to the output of regulator tubes, is connected to ground only through switch S102 (polarity).

In order to provide high voltage indication, neon lamp DS101 (HV REGULATOR ON) and resistor R129 are shunted across the regulator resistor R101. The lamp DS101 will not light for either of these conditions:

1. Power supply defective.
2. Gaseous regulator tubes V101 through V104 defective (but Hv available, unregulated).
3. POLARITY REVERSING CIRCUIT: By reversing the charging voltage to the impulse generator line the polarity of the output pulse can be reversed. Control over the pulse polarity has many operational advantages. Polarity switch S102 provides this control by reversing the connections of ground and voltage output across the regulator string V101 through V104.
4. ATTENUATOR: The spectral output of the impulse generator is directly proportional to the charging potential. Accordingly, a very accurate voltage divider-type step attenuator has been placed between the voltage output from polarity switch S102 and ground and the charging potential for the impulse line is taken from the divider output.

   The individual resistors from which the voltage divider is assembled are accurate to one percent. This ensures good overall attenuator accuracy.

The number of attenuator steps and the resistor values were chosen so that the impulse generator output can be varied from 10 to 101 dB above one microvolt-per-megahertz in 0.25 dB steps.

Differences exist in the inherent output between individual Impulse Generators. Therefore each equipment is set to the correct output by adjusting internal voltage control R103.

Section III

# INSTALLATION

## 3-1. SCOPE OF THIS SECTION

Procedures for setting up the Model 91263-1 Impulse Generator for operation are contained in this section; actual operating procedures are contained in the succeeding Section IV, Operation. The Impulse Generator is portable equipment and no provisions are made for permanent mounting or fixed installation.

## 3-2. POWER SUPPLY REQUIREMENTS

This equipment must be operated at 105 to 125 volts ac, or 210 to 250 volts ac single phase, 50 to 60 hertz per second. Power consumption is approximately 30 watts at 115 volts, 60 hertz. The power line selector switch, S106, at the back of the case must be set to the correct position (115V or 230V) to correspond to the power source voltage.

## 3-3. INITIAL EQUIPMENT SETUP

SETUP:

Step 1. Place the Impulse Generator equipment on a convenient bench or other flat surface, on the four feet provided.

WARNING

Because of the mercury switch the generator will not operate satisfactorily if the equipment is tilted greater than 30 degrees from vertical.

Step 2. A one (1) ampere slo-blo fuse must be in the fuse holder for 115V power line operation and a 0.5 ampere slo-blo fuse used for 230V power line generation.

Step 3. Connect the plug on the end of the power cable to an external power source. The power line cable uses a three-pronged, polarized male plug - the third pin carrying the grounding circuits. A two-contact adapter is supplied for use with the three-pronged plug when a three-pin power receptacle is not available. When using the adapter connect a good ground to the adapter grounding wire.

## 3-4. ELECTRICAL ADJUSTMENTS

All internal alignment and calibration adjustments on the Impulse Generator are made at the factory and no further adjustment is required prior to operation.

Section IV

# OPERATION

## 4-1. GENERAL

Turn the "POWER" switch to "ON". No equipment warm up period is required.

NOTE

This equipment should not be operated unless the "HV REGULATOR ON" indicator is lighted. The lamp serves to indicate "POWER ON" conditions and operation of the voltage regulator tubes in charging voltage circuit.

## 4-2. OPERATING INSTRUCTIONS

a. LOAD IMPEDANCE:

The Impulse Generator is designed to work into a 50 ohm resistive load. Therefore, connect the output of the Impulse Generator to the load by a 50 ohm coaxial cable remembering that the accuracy of output is dependent on the load impedance.

b. OUTPUT SIGNAL:

The output from the Impulse Generator is in terms of dB above one microvolt-per-megahertz and its level is the sum of the dB values indicated by the three attenuator dials.

The pulse output from the generator is an impulse signal. A pulse is considered "impulsive" when its duration is very much less than the reciprocal of the bandwidth of the detecting instrument. Stated differently, a pulse is considered impulsive when the overall rise time of the detecting instrument is long compared to the pulse duration. The generator output would no longer be considered impulsive when the detecting instrument rise time approached the pulse duration. For example: With a pulse duration of 0.0005 microseconds time, and a bandpass type circuit, the bandwidth would need to be approximately:

$$B = \frac{0.7}{T} = \frac{0.7}{.0005} = 1400 \text{ megahertz.,}$$

where:

B = bandwidth = 3 dB down in megaHertz.

T = rise time of bandpass circuit in microseconds.

For all practical purposes the output of this generator can be considered impulsive. For the practical detecting instrument used below 1000 mega-Hertz and subject to impulsive signal input, the output will be inversely proportional to rise time and directly proportional to bandwidth.

c. PULSE POLARITY:

The polarity of the output pulse can be selected, as desired, with the front panel control marked "PULSE POLARITY", "POS-NEG".

d. DETECTING INSTRUMENT OVERLOAD:

Always be watchful of receiver overload when operating with the broad-band output from the Impulse Generator. Overload is indicated if the receiver output changes when the generator pulse polarity is reversed. Since the generator output level does not change with polarity reversal, the change must be due to receiver overload. The input level at which the receiver overloads can be determined by increasing the generator output by constant increments and noting the level at which the receiver output becomes non-linear.

Overload usually occurs in the first stage of an amplifier or receiver. This is because of insufficient selectivity ahead of the first tube. This results in excessive pulse signal amplitude as explained in paragraph b, above. Should this happen, the following corrective steps should be taken:

1. Increase the i.f. amplifier gain to maximum. This permits the same output indication with a lower input signal.
2. Should receiver overload persist check the alignment of the "front-end" tuned circuits.
3. Overload may be due to spurious responses of the input circuits to higher frequencies. In this case use a low-pass filter at the receiver input. The filter cut-off frequency should be as close as practicable above the highest operating frequency.

   When using a Radio Interference and Field Intensity equipment in the Field Intensity (FI) or Quasi-Peak (QP) detector function positions, overload can be aggrevated because of the low "duty cycle" of the

impulse signal. At 60 pulses-per-second the "average" voltage appearing at the detector and indicated by the FI function will be negligible unless the bandwidth is extremely narrow. This means the input signal amplitude will have to be increased many times that required of the PEAK (slideback) detector function. The QP detector function is much better than the FI function because its charge and discharge time constants (1ms charge and 600 ms discharge, standard accepted constants) do not permit complete voltage buildup. When permissible, the final step to be taken to eliminate overload is to use a detector function most immune to the affects of low pulse repetition rate.

## 4-3. IMPULSE INTERFERENCE MEASUREMENT

The Model 91263-1 Impulse Generator is an excellent calibrating standard for use with Radio Interference and Field Intensity equipment. For RI-FI meters not equipped with an internal impulse generator an external generator is a time saver in the measurement of impulse interference. Its use permits the measurement of impulse signals directly in terms of microvolts-per-kilohertz or in dB above one microvolt-per-megahertz without involving bandwidth computations.

a. MEASURING SMALL IMPULSE SIGNAL LEVELS:

The following procedure is for measuring signal levels that do not exceed 112,000 microvolts-per-megahertz or 112 microvolts-per-kilohertz. This method can only be used with 50 ohm resistive input circuits.

Step 1. Take a PEAK or "slide-back" measurement of the impulsive interference signal with the RI-FI equipment. There is no need to standardize the gain of the equipment but it is advisable to operate with the lowest attenuator step and the highest i.f. amplifier gain setting practicable. See paragraph d, page 4-2.

Step 2. Without disturbing the RI-FI meter controls substitute the impulse generator signal for the unknown signal. Adjust the generator output level for the same slide-back indication noted in Step 1 above.

Step 3. For conductive measurements the unknown signal level (across the RI-FI meter 50-ohm resistive input terminals) is equal to the output

of the impulse generator. The output can be read directly from the attenuator controls and is in terms of dB above one microvolt-per-megahertz bandwidth. To change the reading to microvolts-per-kilohertz subtract 60 dB and convert the remaining dB value to voltage ratio by means of Tables 4-2 and 4-3.

When measuring radiated impulse interference with a pick-up device, multiply the final reading of Step 3 by the antenna factor to obtain the "slide-back" value of field intensity in microvolts-per-meter-per-kilohertz. This measurement is only possible with pick-up devices that are designed to work into a 50-ohm circuit, for example, the antennas and probes used with the AN/URM-17, NM-50 and AN/URM-47, NM-30, equipments.

NOTE

The NM-30A, NM-52A and AN/URM-47A equipments do not present a 50-ohm DC path for the Impulse Generator. Therefore a Singer attenuator No. 90530-10 or equivalent must be connected between the Impulse Generator and the receiving equipment.

Error due to cable losses will be eliminated if the same cable is used between Impulse Generator and RI-FI meter as between the pick-up device and RI-FI meter. This treatment also applies to conducted interference measurements.

EXAMPLE: Assume a pick-up device factor of 7 and a signal level as read on the Impulse Generator, of 81 dB above one microvolt-per-megahertz. Find:

1. The field intensity in dB above one microvolt-per-meter-per-megahertz.

2. The field intensity in microvolts-per-meter-per-kilohertz. From Table 4-1 a voltage ratio (antenna factor) of 7 is 16.9 dB. The field intensity in dB above one microvolt-per-meter-per megahertz will be the sum of the signal level in dB, across 50-ohms, plus the antenna factor in dB.

   81 dB + 16.9 dB = 97.9 dB above one microvolt-per-meter-per-megaHertz

Converting the signal level to a dB above one microvolt-per-kilohertz basis,

81 dB - 60 dB = 21 dB above one microvolt-per-kilohertz

From Tables 4-2 and 4-3, 21 dB is equivalent to a voltage ratio of 11.22. The signal level across 50-ohms if then 11.22 microvolts-per-kilohertz. Multiplying this by the antenna factor gives the field intensity of

$11.22 \times 7 = 78.54$ microvolts-per-meter-per-kilohertz

b. MEASURING LARGE IMPULSE SIGNAL LEVELS:

The maximum output of the Impulse Generator is 112,000 microvolts-per-megahertz of 112 microvolts-per-kilohertz. When the unknown signal level exceeds this the following measurement procedure is recommended. This method can only be used with 50-ohm resistive input circuits.

Step 1. Take a PEAK or "slide-back" measurement of the impulsive interference signal with the RI-FI equipment. There is no need to standardize the gain of the equipment but it is advisable with the lowest attenuator step and the highest i.f. amplifier gain setting practicable. see paragraph d, page 4-2.

Step 2. Substitute the Impulse Generator signal for the unknown signal. Adjust the Impulse Generator output level to 100 dB above one microvolt-per-megahertz. Then, by adjusting only the RI-FI meter PEAK (slide-back) and Attenuator controls take a "slide-back" reading of the Impulse Generator output.

Step 3. Subtract the RI-FI meter reading (meter scale reading in dB plus the attenuator setting in dB) of the Impulse Generator output in Step 2 from the RI-FI meter reading of the signal of Step 1. This difference in dB plus 100 dB is the signal level in dB above one microvolt-per-megahertz. To change the reading to microvolts-per-kilohertz subtract 60 dB and convert the remaining dB value to voltage ratio by means of Tables 4-2 and 4-3. When measuring radiated impulse interference

with a pickup device, multiply the final reading of Step 3 by the antenna factor to obtain the PEAK value of field intensity in microvolts-per-meter-per-kilohertz.

NOTE

This measurement is only possible with pickup devices that are designed to work into a 50-ohm resistive circuit. Error due to cable losses will be eliminated if the same cable is used between the Impulse Generator and RI-FI meter as between the pickup device and RI-FI meter. This also applies to the measurement of conducted interference.

EXAMPLE: Assume a pickup device factor of 15, a Step 1 measurement of 130 dB and a Step 2 measurement of 106 dB. The signal level is:

130 dB - 106 dB + 100 dB = 124 dB above one microvolt-per-megahertz, or 64 dB above one microvolt-per-kilohertz.

From Tables 4-2 and 4-3 64 dB is a voltage ratio of 1,585. The voltage across the RI-FI meter 50-ohm input terminals is then 1,585 microvolts-per-kilohertz. The field intensity is:

1,585 × 15 = 23,775 microvolts-per-meter-per-kilohertz.

## 4-4. BANDWIDTH MEASUREMENT

The impulse bandwidth of a receiver or amplifier can be measured at any frequency up to 1000 mcs by comparing the sine wave sensitivity with the impulse sensitivity. Since the Impulse Generator output is constant per unit bandwidth up to 1000 megahertz, any change in the impulse sensitivity not attended by a proportionate change in the sine wave sensitivity is an indication of change in bandwidth.

The following procedure can be used for determining impulse bandwidth of an RI-FI meter or any receiver or amplifier equipped with a "slide-back" detector.

Step 1. Adjust the output of the Impulse Generator at some convenient level well above the internal noise level of the equipment under test. Adjust the equipment "slide-back" control so the impulse generator signal is just above the cut-off point.

NOTE

Overload precautions must be observed during this portion of the bandwidth measurement. See paragraph d, page 4-2.

Step 2. Without changing any equipment controls substitute an accurate sine wave generator for the Impulse Generator. Tune the generator frequency to exact center frequency of equipment under test. Adjust generator output level for the same "slide-back" just above cut-off point reading as in Step 1 above. A very low level of modulation may be used as an aid in determining this point. Note the sine wave generator output.

NOTE

The sine wave generator must have a 50-ohm output impedance and both generators must be working into the same 50-ohm load. At higher frequencies the same 50-ohm RF cable should be used so cable losses will be identical.

Step 3. The impulse bandwidth can then be found by dividing the sine wave generator output in microvolts by the impulse generator output in microvolts-per-megahertz.

EXAMPLE: Assume a Step 1 impulse generator level of 60 dB above one microvolt-per-megahertz and a Step 2 sine wave generator output of 200 microvolts. Determine the impulse bandwidth.

From Table 4-2 and 4-3, the impulse bandwidth is:

$$\frac{200\ \mu v}{1000\ \mu v/mc} = 0.2 \text{ megahertz or } 200 \text{ kilohertz}$$

## Table 4-1. Converting Voltage Ratios into dB Values

The following table is for converting voltage ratios into dB values. For voltage ratios greater than 10.0 but less than 100, divide by 10 and add 20 dB to the dB value found in the following table for the quotient. For voltage ratios greater than 100 but less than 1000, divide by 100 and add 40 dB to the value found in the table for the quotient, and so on.

| Voltage Ratio | Plus Fractional Part .00 dB | .05 dB | Voltage Ratio | Plus Fractional Part .00 dB | .05 dB |
|---|---|---|---|---|---|
| 1.0 | 0.000 | 0.424 | 4.5 | 13.064 | 13.160 |
| 1.1 | 0.828 | 1.214 | 4.6 | 13.255 | 13.349 |
| 1.2 | 1.584 | 1.938 | 4.7 | 13.442 | 13.534 |
| 1.3 | 2.279 | 2.607 | 4.8 | 13.625 | 13.715 |
| 1.4 | 2.923 | 3.227 | 4.9 | 13.804 | 13.892 |
| 1.5 | 3.522 | 3.807 | 5.0 | 13.979 | 14.066 |
| 1.6 | 4.082 | 4.350 | 5.1 | 14.151 | 14.236 |
| 1.7 | 4.609 | 4.861 | 5.2 | 14.320 | 14.403 |
| 1.8 | 5.105 | 5.343 | 5.3 | 14.486 | 14.567 |
| 1.9 | 5.575 | 5.801 | 5.4 | 14.648 | 14.728 |
| 2.0 | 6.021 | 6.235 | 5.5 | 14.807 | 14.886 |
| 2.1 | 6.444 | 6.649 | 5.6 | 14.964 | 15.041 |
| 2.2 | 6.848 | 7.044 | 5.7 | 15.117 | 15.193 |
| 2.3 | 7.235 | 7.421 | 5.8 | 15.269 | 15.343 |
| 2.4 | 7.604 | 7.783 | 5.9 | 15.417 | 15.490 |
| 2.5 | 7.959 | 8.131 | 6.0 | 15.563 | 15.635 |
| 2.6 | 8.299 | 8.465 | 6.1 | 15.707 | 15.778 |
| 2.7 | 8.267 | 8.787 | 6.2 | 15.848 | 15.918 |
| 2.8 | 8.943 | 9.097 | 6.3 | 15.987 | 16.055 |
| 2.9 | 9.248 | 9.396 | 6.4 | 16.124 | 16.191 |
| 3.0 | 9.542 | 9.686 | 6.5 | 16.258 | 16.325 |
| 3.1 | 9.827 | 9.966 | 6.6 | 16.391 | 16.456 |
| 3.2 | 10.103 | 10.238 | 6.7 | 16.521 | 16.586 |
| 3.3 | 10.370 | 10.501 | 6.8 | 16.650 | 16.714 |
| 3.4 | 10.630 | 10.756 | 6.9 | 16.777 | 16.840 |
| 3.5 | 10.881 | 11.005 | 7.0 | 16.902 | 16.964 |
| 3.6 | 11.126 | 11.246 | 7.1 | 17.025 | 17.086 |
| 3.7 | 11.364 | 11.481 | 7.2 | 17.147 | 17.207 |
| 3.8 | 11.596 | 11.709 | 7.3 | 17.266 | 17.326 |
| 3.9 | 11.821 | 11.932 | 7.4 | 17.385 | 17.443 |
| 4.0 | 12.041 | 12.149 | 7.5 | 17.501 | 17.559 |
| 4.1 | 12.256 | 12.361 | 7.6 | 17.616 | 17.673 |
| 4.2 | 12.465 | 12.568 | 7.7 | 17.730 | 17.786 |
| 4.3 | 12.669 | 12.770 | 7.8 | 17.842 | 17.897 |
| 4.4 | 12.869 | 12.967 | 7.9 | 17.953 | 18.007 |

Table 4-1. Converting Voltage Ratios into dB Values (Continued)

| Voltage Ratio | Plus Fractional Part .00 dB | .05 dB | Voltage Ratio | Plus Fractional Part .00 dB | .05 dB |
|---|---|---|---|---|---|
| 8.0 | 18.062 | 18.116 | 9.0 | 19.085 | 19.133 |
| 8.1 | 18.170 | 18.223 | 9.1 | 19.181 | 19.228 |
| 8.2 | 18.276 | 18.329 | 9.2 | 19.276 | 19.323 |
| 8.3 | 18.382 | 18.434 | 9.3 | 19.370 | 19.416 |
| 8.4 | 18.486 | 18.537 | 9.4 | 19.463 | 19.509 |
| 8.5 | 18.588 | 18.639 | 9.5 | 19.554 | 19.600 |
| 8.6 | 18.690 | 18.740 | 9.6 | 19.645 | 19.691 |
| 8.7 | 18.790 | 18.840 | 9.7 | 19.735 | 19.780 |
| 8.8 | 18.890 | 18.939 | 9.8 | 19.825 | 19.869 |
| 8.9 | 18.988 | 19.036 | 9.9 | 19.913 | 19.956 |
| | | | 10.0 | 20.000 | 20.043 |

The following table is for converting dB values into voltage ratios. For dB values greater than 20 dB but less than 40 dB, subtract 20 dB and move the decimal point one position to the right in the voltage ratio found in Table 4-3 for the remainder. For dB values greater than 40 dB but less than 60 dB, subtract 40 dB and move the decimal point 2 places to the right, see Table 4-2

Table 4-2. Converting dB Values into Voltage Ratios (20 dB - 160 dB)

| dB Value Range | Subtract dB | Number of Places to Move Voltage Ratio Decimal Point to the Right |
|---|---|---|
| 0- 20 | 0 | 0 |
| 20- 40 | 20 | 1 |
| 40- 60 | 40 | 2 |
| 60- 80 | 60 | 3 |
| 80-100 | 80 | 4 |
| 100-120 | 100 | 5 |
| 120-140 | 120 | 6 |
| 140-160 | 140 | 7 |

Table 4-3. Converting dB Values into Voltage Ratios (0 dB - 20 dB)

| dB Value | .00 | .25 | .50 | .75 |
|---|---|---|---|---|
| 0 | 1.000 | 1.029 | 1.059 | 1.090 |
| 1 | 1.122 | 1.154 | 1.189 | 1.223 |
| 2 | 1.259 | 1.296 | 1.334 | 1.373 |
| 3 | 1.413 | 1.453 | 1.496 | 1.540 |
| 4 | 1.585 | 1.631 | 1.679 | 1.728 |
| 5 | 1.778 | 1.831 | 1.884 | 1.939 |
| 6 | 1.995 | 2.054 | 2.113 | 2.176 |
| 7 | 2.239 | 2.304 | 2.371 | 2.441 |
| 8 | 2.512 | 2.585 | 2.661 | 2.739 |
| 9 | 2.818 | 2.900 | 2.985 | 3.072 |
| 10 | 3.162 | 3.255 | 3.350 | 3.447 |
| 11 | 3.548 | 3.652 | 3.758 | 3.868 |
| 12 | 3.981 | 4.097 | 4.217 | 4.340 |
| 13 | 4.467 | 4.597 | 4.732 | 4.870 |
| 14 | 5.012 | 5.159 | 5.309 | 5.464 |
| 15 | 5.623 | 5.787 | 5.957 | 6.131 |
| 16 | 6.310 | 6.494 | 6.683 | 6.879 |
| 17 | 7.079 | 7.286 | 7.499 | 7.718 |
| 18 | 7.943 | 8.175 | 8.414 | 8.660 |
| 19 | 8.913 | 9.173 | 9.441 | 9.717 |
| 20 | 10.000 | | | |

Section V

# MAINTENANCE

## 5-1. INTRODUCTION

The procedure, illustrations, and tables in this section are for the purpose of assisting maintenance personnel in the repair of the Model 91263-1 Impulse Generator. When the equipment has failed in operation, the source must be located, the defect remedied, and the equipment restored to operation. The information is, therefore, presented in the following order.

Localization of Trouble. (paragraph 5-2)

Removal of Chassis from Instrument Case. (Paragraph 5-3)

Impulse Generator Troubleshooting and Repair.

An overall schematic is provided at the end of this section. A table of tube operating voltages (Table 5-1) immediately precedes the schematic.

## 5-2. LOCALIZATION OF TROUBLE

### INTRODUCTION

Trouble shooting in the Impulse Generator can be accomplished in the same manner as any other electronic equipment. Inspect the entire assembly in an attempt to isolate the trouble. Determine that the required power is applied to the equipment. The indicator lamp DS101 serves to indicate power application and operation of the voltage regulator tubes. Determine whether or not an output can be obtained from the Impulse Generator.

WARNING

The Impulse Generator operates at high dc voltages. The power source should be disconnected before removing the case from the Impulse Generator.

## 5-3. REMOVAL OF CHASSIS FROM INSTRUMENT CASE

After determining that the source of trouble is in the Impulse Generator, the next procedure is to remove the equipment from the case.

To open the Impulse Generator, stand the unit on its panel guards, face down. Remove E105, the adapter at the end of the 6 ft. power cord. Remove the two screws from the rear of case and slide the case off the chassis. Pull the cable through the relief hole in the case.

The equipment is reassembled in essentially the reverse sequence as given for removal.

## 5-4. IMPULSE GENERATOR TROUBLE SHOOTING AND REPAIR

WARNING

The impulse generator line 91396-1, Z101, is located near the panel edge of the chassis. Extreme care should be exercised when handling or replacing this assembly. Z101 utilizes a glass-encased mercury switch containing an inert gas under pressure.

a. TUBE REPLACEMENT

The miniature tubes of this equipment are held in place by spring-loaded tube shields. To remove, depress and turn the tube shield counter-clockwise, then lift. Do not remove any tube without first turning off the equipment.

The four 0A2 gaseous tubes (V101, V102, V103, V104) are located along the rear of the chassis. An indication of defective tube is the absence of a bluish glow near the base of the tube and non-operation of the HV REGULATOR on lamp when power switch is in ON position.

b. TROUBLE SHOOTING

If there is no output pulse detected from the Impulse Generator, check the following, with attenuator switches set for 101 dB above 1 microvolt-per-megaHertz and polarity switch in positive position.

1. Examine the one-ampere fuse F101
2. The voltage at the top of Impulse Generator line Z101 should be approximately 600 volts dc with respect to chassis as measured with a 20,000 ohm-per-volt meter. If the voltage departs by more than 10%, check for defective V101, V102, V103, V104, CR101, C102, R101 or R130.

3. A 50 to 60 Hertz buzzing should be audible in the impulse line Z101. If this sound is not present check the coil driving voltage Z101. Measure this voltage across the two coil leads extending from Z101. This voltage should be approximately 5 volts pulsating dc. This measurement can be made with an oscilloscope. A cause of insufficient drive voltage could be a defective CR102 rectifier or a shorted driving coil.

c. REPLACEMENT OF PARTS

Defective parts should be replaced with correct parts as listed in Section 6.

Table 5-1. Tube Operating Voltages

| Symbol | Tube Type | Function | Plate Pin #5 | Cathode Pin #7 |
|---|---|---|---|---|
| V101 | 0A2 | Voltage Regulator | 600 | 450 |
| V102 | 0A2 | Voltage Regulator | 450 | 300 |
| V103 | 0A2 | Voltage Regulator | 300 | 150 |
| V104 | 0A2 | Voltage Regulator | 150 | 0 |

1. All voltages measured with 20,000 ohm-per-voltmeter.
2. All measurements are made from the point indicated to chassis.
3. All measurements made with attenuator switches adjusted for maximum output and polarity switch in POSITIVE position.

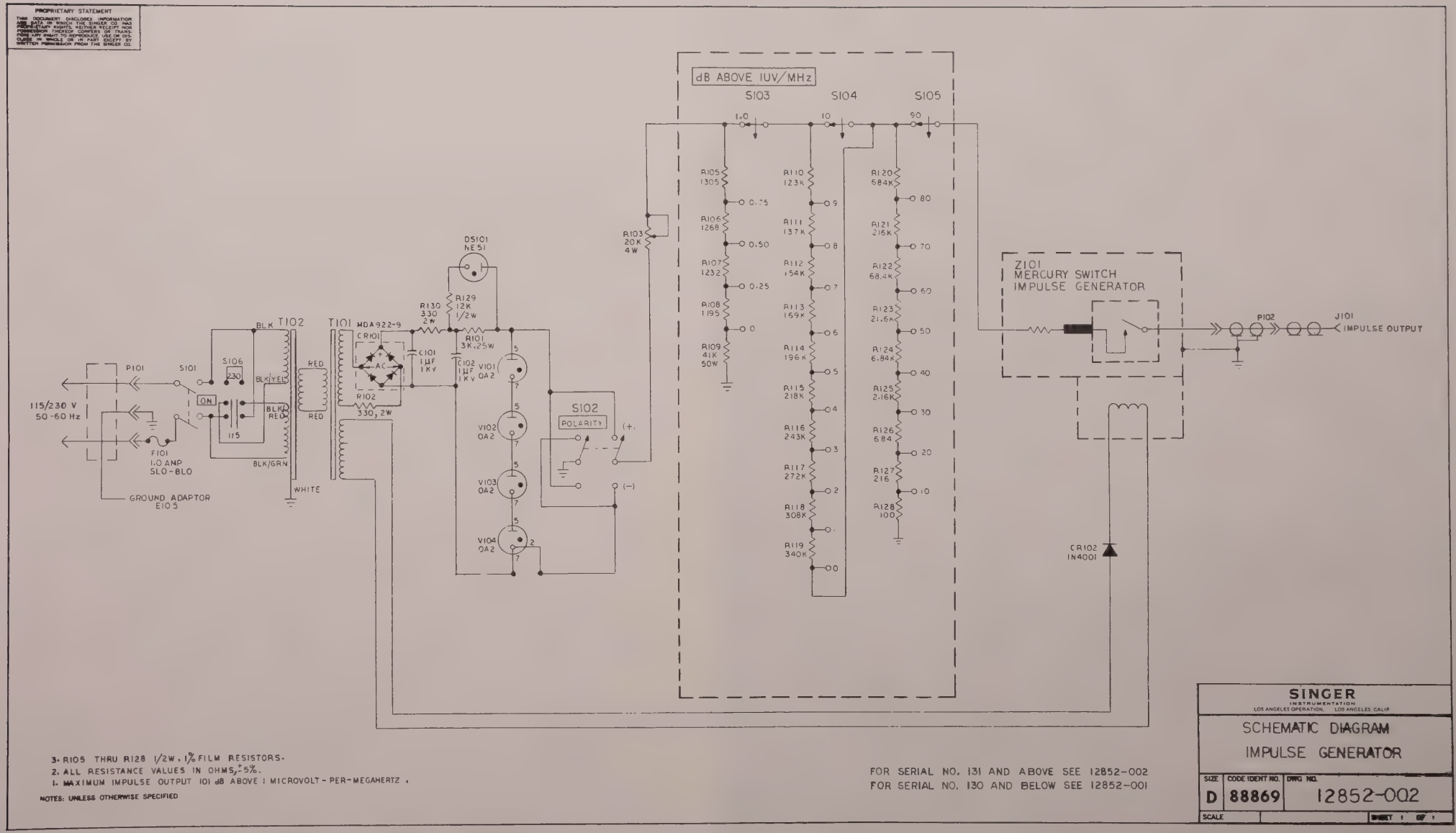


Figure 5-1. Impulse Generator Schematic Diagram

Section VI

# PARTS LIST

## 6-1. INTRODUCTION

Reference symbols have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included in the drawings, diagrams and the parts list. The letter of the reference designation indicates the kind of part (generic group), such as resistor or electron tube. Sockets associated with particular plug-in devices, such as electron tubes or fuses are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for tube V101 is designated XV101.

## 6-2. MAINTENANCE PARTS LIST

Table 6-1 lists all the maintenance parts required for the Impulse Generator. Column 1 lists the reference series of the major unit, followed by the reference designations of the various parts in alphabetical and numerical order. Column 2 refers to the notes applicable to those items that require such notes for manufacturer design, listed for reference only, Federal procurement data, etc. Column 3 gives the name and describes the various parts. Complete information is given for all key parts (parts differing from any part previously listed in this table) and sub-key parts (parts identical with a key part but appearing for the first time for a major unit). The name and description are omitted for other parts. However, reference is made to the key part or sub-key part for the data. Column 4 indicates how the part is used and gives its functional location in the equipment.

## 6-3. LIST OF MANUFACTURERS

Table 6-2 lists manufacturers of parts used in the equipment. The first column includes the abbreviations used in Table 6-1 to identify manufacturers.

Table 6-1. Maintenance Parts List

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| C101 | | CAPACITOR, FIXED, PAPER, OIL-FILLED: 1 mfd; +20%; 1000 vdc, Type DYR-10100, Singer No. 1-900124 | B+ Filter |
| C102 | | Same as C101 | B+ Filter |
| CR101 | | DIODE BRIDGE, SILICON, Motorola MDA 927-9, Singer P/N 1-913079-001 | Rectifier, charge voltage |
| CR102 | | DIODE, SILICON, Motorola 1N4004, Singer P/N 1-913001-004 | Rectifier, coil voltage |
| CR103 | | Not used | |
| CR104 | | Not used | |
| CR105 | | Not used | |
| CR106 | | Not used | |
| DS101 | | LAMP, GLOW: 56 vdc average, maintaining volts; 0.2ma; 1-3/16 in. lg; T-3-1/4 bulb; min. bayonet base; CG No. NE-51; CADV No. NE-51 | HV regulator on lamp |
| E101 | | SHIELD, ELECTRON TUBE: for 7-pin miniature socket; JAN-S-28A spec; JAN- No. TS102U02; CADV No. 10039 | Shield for V101 |
| E102 | | Same as E101 | Shield for V102 |
| E103 | | Same as E101 | Shield for V103 |
| E104 | | Same as E101 | Shield for V104 |
| E105 | | ADAPTER, AC INPUT: adapts 3-conductor grounding cap circuit to 2-conductor plug; CHU; CADV 11146 | AC input adapter |
| E106 | | KNOB, BAR: black phenolic; CALH No. C-64969-1G; CADV No. 10134 | 0.25 db atten. step knob |
| E107 | | Same as E106 | 1.0 db atten. step knob |
| E108 | | Same as E106 | 10 db atten. step knob |

Table 6-1. Maintenance Parts List (Continued)

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| E109 | | Same as E106 | Polarity switch knob |
| F101 | | FUSE, CARTRIDGE: 1 amp at 250 v; CFA No. AGC-1.0-250v; CADV No. 10739 | AC line input fuse |
| F102 | | Same as F101 | Spare fuse |
| J101 | | CONNECTOR, RECEPTACLE: coaxial Type "N"; UG-30/U; CPH No. 8266; CADV No. 11137 | Output connector |
| P101 | | PLUG: 3-conductor grounding cap; p/o W101; not replaceable; listed for reference only | AC input connector |
| P102 | | CONNECTOR, ADAPTER: coaxial; Type "N"; right-angle; UG-27C/U; CPH No. 82-213; CADV No. 10945 | Output connector adapter |
| R101 | | RESISTOR, FIXED, WIREWOUND: 3,000 ohms; +5%; 25 watts; Daleohm No. RH25-3000; CADV No. 10705-302 | Current limiting resistor |
| R102 | | RESISTOR, FIXED, COMPOSITION: 330 ohms; ±5%; 2 watts; CBZ No. HB-3315; CADV No. 10377-331 | Rectifier series resistor |
| R103 | | RESISTOR, VARIABLE, WIREWOUND: 20,000 ohms; ±10%; 3 watts; type linear taper; CMC No. 58C2-20K; CADV No. 10953 | Output adjustment |
| R104 | | Not used | |
| R105 | | RESISTOR, FIXED, DEPOSITED CARBON; 1,305 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-7 | 0.25 db step attenuator |
| R106 | | RESISTOR, FIXED, DEPOSITED CARBON: 1,268 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-6 | 0.25 db step attenuator |
| R107 | | RESISTOR, FIXED, DEPOSITED CARBON: 1,232 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-5 | 0.25 db step attenuator |
| R108 | | RESISTOR, FIXED, DEPOSITED CARBON: 1,195 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-4 | 0.25 db step attenuator |

Table 6-1. Maintenance Parts List (Continued)

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| R109 | | RESISTOR, FIXED, WIREWOUND: 41,000 ohms; ±1%; 50 watts; Daleohm; CADV No. 11132-413 | 0.25 db step attenuator |
| R110 | | RESISTOR, FIXED, DEPOSITED CARBON: 123,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-12 | 1.0 db step attenuator |
| R111 | | RESISTOR, FIXED, DEPOSITED CARBON: 137,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-13 | 1.0 db step attenuator |
| R112 | | RESISTOR, FIXED, DEPOSITED CARBON: 154,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-14 | 1.0 db step attenuator |
| R113 | | RESISTOR, FIXED, DEPOSITED CARBON: 169,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-15 | 1.0 db step attenuator |
| R114 | | RESISTOR, FIXED, DEPOSITED CARBON: 196,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-16 | 1.0 db step attenuator |
| R115 | | RESISTOR, FIXED, DEPOSITED CARBON: 218,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-18 | 1.0 db step attenuator |
| R116 | | RESISTOR, FIXED, DEPOSITED CARBON: 243,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-19 | 1.0 db step attenuator |
| R117 | | RESISTOR, FIXED, DEPOSITED CARBON: 272,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-20 | 1.0 db step attenuator |
| R118 | | RESISTOR, FIXED, DEPOSITED CARBON: 308,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-21 | 1.0 db step attenuator |
| R119 | | RESISTOR, FIXED, DEPOSITED CARBON: 340,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-22 | 1.0 db step attenuator |

Table 6-1. Maintenance Parts List (Continued)

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| R120 | | RESISTOR, FIXED, DEPOSITED CARBON: 684,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-23 | 10 db step attenuator |
| R121 | | RESISTOR, FIXED, DEPOSITED CARBON: 216,000 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-17 | 10 db step attenuator |
| R122 | | RESISTOR, FIXED, DEPOSITED CARBON: 68,400 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-11 | 10 db step attenuator |
| R123 | | RESISTOR, FIXED, DEPOSITED CARBON: 21,600 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-10 | 10 db step attenuator |
| R124 | | RESISTOR, FIXED, DEPOSITED CARBON: 6,840 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-9 | 10 db step attenuator |
| R125 | | RESISTOR, FIXED, DEPOSITED CARBON: 2,160 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-8 | 10 db step attenuator |
| R126 | | RESISTOR, FIXED, DEPOSITED CARBON: 684 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-3 | 10 db step attenuator |
| R127 | | RESISTOR, FIXED, DEPOSITED CARBON: 216 ohms; ±1%; 1/2 watt; Daleohm; CADV No. 10935-2 | 10 db step attenuator |
| R128 | | RESISTOR, FIXED, DEPOSITED CARBON: 100 ohms;±1%; 1/2 watt; Daleohm; CADV No. 10935-1 | 10 db step attenuator |
| R129 | | RESISTOR, FIXED, COMPOSITION: 12,000 ohms; ±5%; 1/2 watt; CBZ No. EB-1235; CADV No. 10011-123 | 10 db step attenuator |
| R130 | | Same as R102 | Filter |
| S101 | | SWITCH, TOGGLE: DPDT: 125 v, 3 amps; 250 v, 1 amp; CHH No. 20905; CADV No. 10172 | Power switch |

Table 6-1. Maintenance Parts List (Continued)

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| S102 | | SWITCH, ROTARY: 2 positions; Singer P/N 1-951044-001 | Polarity switch |
| S103 | | SWITCH, ROTARY: 5 positions; Singer P/N 1-951043-004 | 0.25 db step attenuator switch |
| S104 | | SWITCH, ROTARY: 11 positions; Singer P/N 1-951043-010 | 1.0 db step attenuator switch |
| S105 | | SWITCH, ROTARY: 9 positions; Singer P/N 1-951043-009 | 10 db step attenuator switch |
| S106 | | SWITCH, SLIDE, DPDT Singer P/N 1-951003-001 | 115/230v |
| T101 | | TRANSFORMER, POWER: primary 115 volts; 50-60 cps; secondary No. 1, 600 volts at 40 ma; secondary No. 2, 6.3 volts at 1 amp; CAAC No. 5467-1; CADV No. 10940 | Power transformer |
| V101 | | ELECTRON TUBE: type 0A2 | Voltage regulator |
| V102 | | Same as V101 | Voltage regulator |
| V103 | | Same as V101 | Voltage regulator |
| V104 | | Same as V101 | Voltage regulator |
| W101 | | CABLE, POWER: 3 conductors; 6-1/2 feet long; P101 one end; CADV No. 91245-1 | Power input cable |
| XF101 | | HOLDER, FUSE: for 3 AG type fuse; CLF No. 3410-01; CADV No. 10018 | Fuse holder for F101 |
| XF102 | | Same as XF101 | Spare fuse holder |
| XI101 | | SOCKET, LIGHT, INDICATOR: with lens; CEJ No. 147-1142; CADV No. 11441 | I101 socket |
| XV101 | | SOCKET, TUBE: 7 contacts; miniature; CEB No. TS102C01; CADV No. 10118 | Tube socket for V101 |

Table 6-1. Maintenance Parts List (Continued)

| Reference Symbol | Notes | Name and Description | Locating Function |
|---|---|---|---|
| V102 | | Same as XV101 | Tube socket for V102 |
| XV103 | | Same as XV101 | Tube socket for V103 |
| XV104 | | Same as XV101 | Tube socket for V104 |
| Z101 | | IMPULSE LINE: consists of one driving coil, one resistor, one coaxial line and one mercury switch; requires driving voltage of 6.3 volts pulsating dc at 50-60 pps repetition rate; charging voltage 600 volts dc for 101 db above one microvolt-per-megacycle output; output pulse width 0.0005 microsecond; pulse repetition rate 50-60 pps; CADV No. 91396-1 | Impulse generator |

Table 6-2. List of Manufacturers

| Abbreviation | Name | Address |
|---|---|---|
| CAW | Aerovox Wireless Corp. | 700 Belleville Ave.<br>New Bedford, Mass. |
| CBZ | Allen Bradley Co. | 118 W. Greenfield Ave.<br>Milwaukee, Wisconsin |
| CEB | Eby, Hugh H. | 4700 Stenton Ave.<br>Philadelphia, Pa. |
| CEJ | E. F. Johnson Co. | Waseco, Minn. |
| CFA | Bussman Mfg. Co. | 2538 W. University St.<br>St. Louis, Mo. |
| CHH | Arrow-Hart and Hedgeman Electric Co. | 102 Hawthorne St.<br>Hartford, Conn. |
| CHU | Harvey Hubbell, Inc. | 447 Concord Ave.<br>Bridgeport, Conn. |
| CLF | Littlefuse, Inc. | 1865 Miner St.<br>Des Plaines, Ill. |
| CMC | Clarostat Mfg. Co. | 285-287 N. 6th Street<br>Brooklyn, New York |
| CPH | American Phenolic Corp. | 1830 So. 54th. Ave.<br>Chicago, Ill. |
| CAAC | New York Transformer Co. | 26 Waverly Place<br>New York, 3, N. Y. |
| CADV | Stoddart Aircraft Radio Co., Inc. | 6644 Santa Monica Blvd.<br>Hollywood 38, California |
| CALH | General Television & Radio Co. | 1240 N. Holman Ave.<br>Chicago 46, Ill. |
| Daleohm | Dale Products Inc. | 1380 28th. Ave.<br>Columbus, Nebraska |
| INT. RECT. CORP. | International Rectifier | 1521 E. Grand Ave.<br>El Segundo, California |

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